Space Weather Technical Forecast

Issued on Saturday, 12 August 2023 at 01:14 Local

This technical forecast provides a four-day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales

Space Weather Forecast Headline: Chance of G1 to start new UTC working week. Chance of R1 throughout.

Analysis of Space Weather Activity over past 24 hours

Solar Activity: Solar activity measured at GOES16 remained Low over the past 24 hours, with occasional C-class flares observed, peaking with a C8.3 at 11/0645UTC from over the northeast limb. Other productive regions included AR3395 in the northwest, and also a faded region near the southwestern limb.

There are now up to five surviving sunspot regions on the Earth-facing side, including two small unipolar unnumbered groups. Of the remainder, AR3395 is nominally the most complex, with some growth in its intermediate spots in the north, as well as the development of up to three candidates for Mt Wilson delta spots. Also of note was AR3397, which saw prolific areal growth, while AR3394 was quieter in the southeast, with a few small spots surrounding the large penumbral spot.

Observed Coronal Mass Ejection (CME) candidates seen in the period were apparently confined to peripheral emission locations. These included narrowly behind the northeastern limb around 11/0630UTC, with a few subsequently emitted from the southeastern limb during the UTC morning and early afternoon. These have been analysed, with no Earth-bound component evident. No CMEs are thought to be en route as a result.

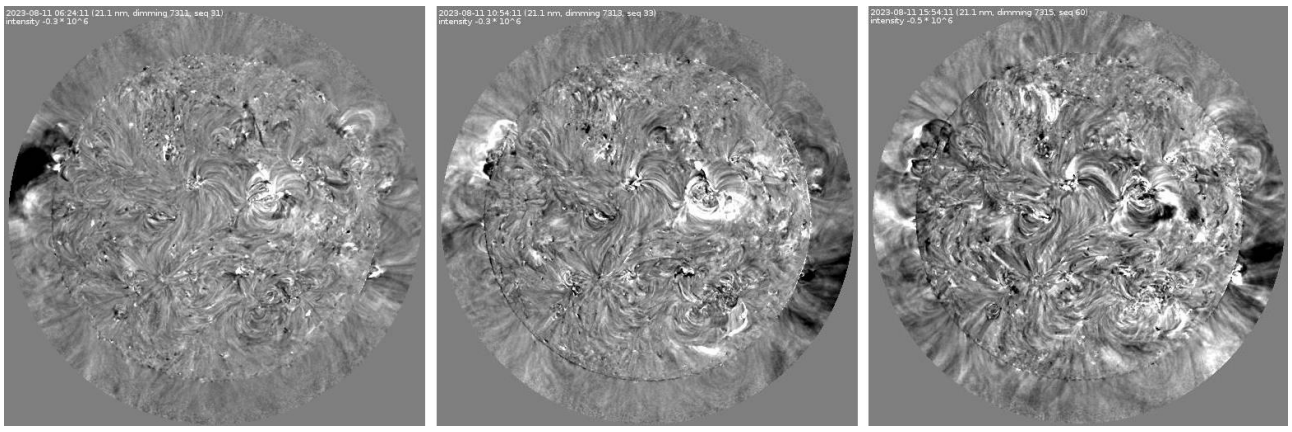

Figure 0: SIDC ROB-processed AIA 211 time-integrated dimmings of CME-generating events in the period. None of these have resulted in Earth-directed CMEs.

Solar Wind / Geomagnetic Activity: Solar winds were Slightly Elevated through the UTC day of Friday 11 August, most likely from a weak negative-polarity high speed stream. The phi angle was accordingly negative (towards the Sun) throughout.

Solar wind speeds observed at L1 by DSCOVR and ACE showed a weak decline from near

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500km/s to finish near 450. The solar wind density remained within its typical single figure ppcc background, while the IMF was erratic but below 8nT throughout. The north-south component varied between +7 and -5nT, again with an erratic character.

The net result of the above solar wind measures was for provisionally Quiet Kp indices throughout, with several intervals recording Kps of '2-'.

Energetic Particles / Solar Radiation: GOES16 high energy (greater than 10MeV) proton flux continued erratically easing, after the enhancement due to the 07 Aug X1.5 flare from Ex-AR3386 (now long-past the western limb). Having peaked at 47pfu early on 09 August, flux remained below the S1 level through the last 24 hours, crossing 1pfu downwards in the period.

High energy (greater than 2MeV) electron flux at GOES16 showed a similar-level diurnal oscillation to the past two days, in ranging from Normal Background to High, peaking at 1390pfu at 11/1745UTC. The associated 24-hour integrated fluence remained below the Active level (1e8 integrated pfu), with a very slight rising trend to reach 4.84e7 integrated pfu at 12/0001UTC.

Four-Day Space Weather Forecast Summary

Solar Activity: There is a daily Chance of M-class X-ray flares, with the main risk from developing region AR3395 in the northwest.

Solar Wind / Geomagnetic Activity: There are no Earth-directed CMEs. The sole fast wind enhancement, CH33/+ is now thought to potentially become geoeffective on day three, Monday 14 August, with a peak Chance of Minor Geomagnetic Storm G1, perhaps extending into the following day, Tuesday 15 August. Geomagnetic activity is otherwise forecast to be mainly Quiet with a chance of isolated Unsettled spells.

Energetic Particles / Solar Radiation: High energy (greater than 10MeV) proton flux (GOES16) is expected to continue declining erratically towards background, with a residual Slight Chance of further enhancements from any of the active regions currently on the disc, with the greatest risk from AR3395 were it to produce a notable flare.

The high energy (greater than 2MeV) electron flux (GOES16) is expected to continue varying between High and Normal Background, as in recent days until the onset of CH33/+. The associated fluence is expected to remain below the Active threshold (1e8 integrated pfu) through this period, although with a probable rebound expected around midweek UTC.

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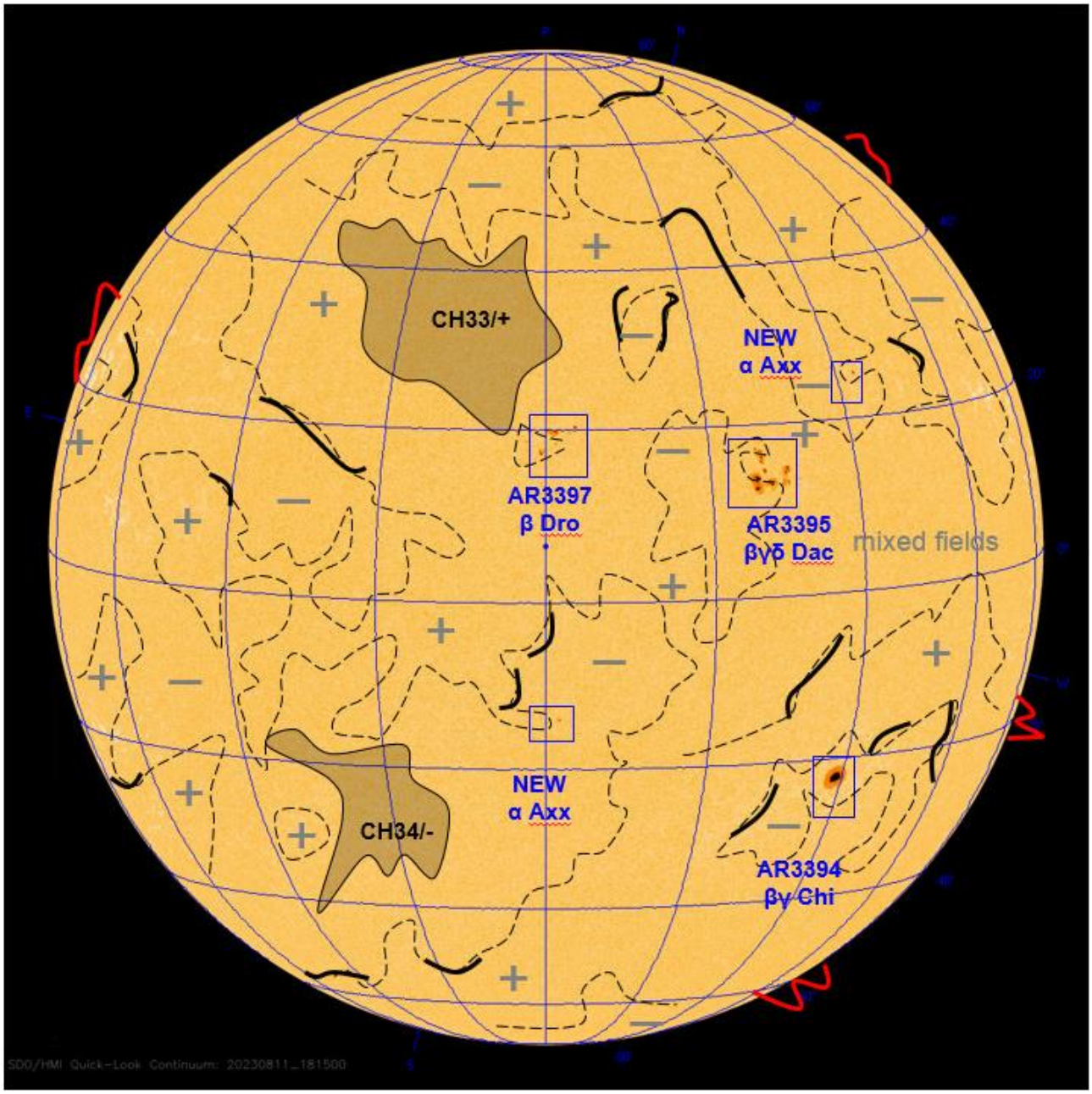
Figure 1. Solar Analysis Valid 11/1815UTC.



Key: Filament ___ , Prominence ___ , Magnetic Field Line - - - , Polarity +/-, Coronal Holes: Grey shaded area CHxx +/-, Sunspot groups 25xx - Mt Wilson α-β-βγ-βγδ and Zurich-McIntosh Axx etc.

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Geomagnetic Storms:

There are no Earth-directed CMEs.

The only fast wind to feature in the forecast is that from CH33/+, now near the solar meridian at high latitudes in the northern hemisphere. While this feature was present in some form on the previous rotation, it is now significantly larger, more intense and has retrogressed. These respectively imply greater and later geomagnetic effects relative to last pass.

The latest iteration of MOSWOC Enlil has this feature as arriving late on 13 August, with a speed of around 500km/s, however this is felt to be a little early for its visible location. On balance, arrival within the UTC day of Monday 14 August seems most likely, with effects potentially continuing into the following UTC day. A Chance of Minor Storm G1 is therefore partitioned between 14 and 15 August, heavily weighted to the former. Geomagnetic activity should otherwise be Quiet over the intervening UTC weekend.

Geo-Magnetic Storm Probability (Exceedance)	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Minor or Moderate	G1 to G2	No	1	1	30	10
Strong	G3	No	1	1	1	1
Severe	G4	No	1	1	1	1
Extreme	G5	No	1	1	1	1

Geomagnetic Activity - Earthbound Coronal Mass Ejections

Nil.

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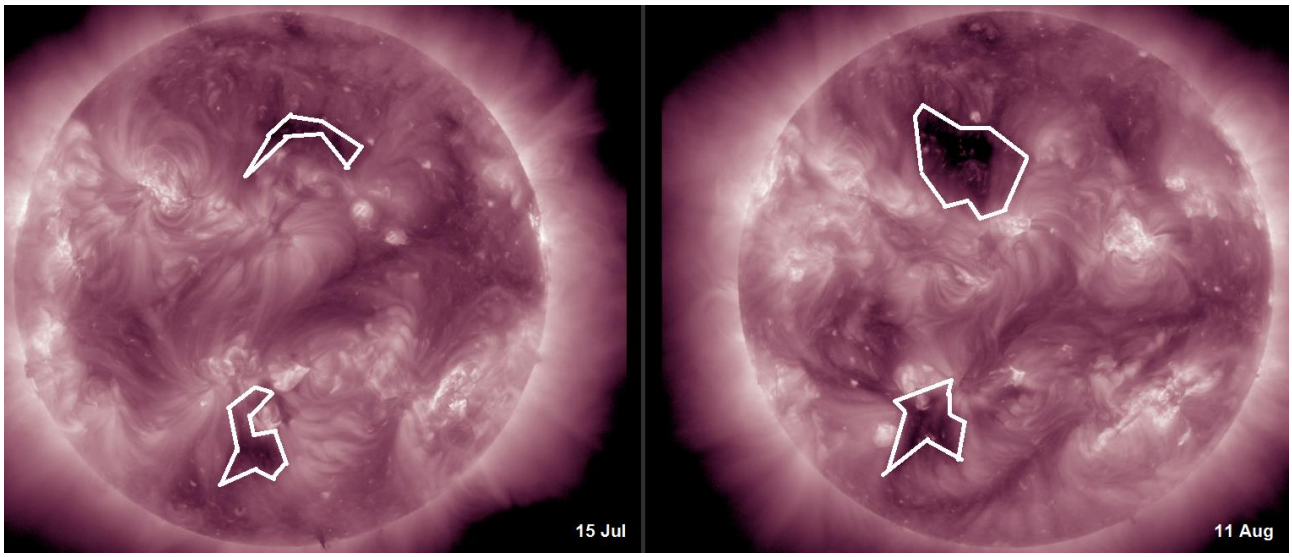
Figure 2: AIA 211 images showing coronal hole geometries between the current and previous rotations. CH33/+ is the northern feature, and can be seen to be larger, more intense and to have retrogressed on the disc, likely leading to later and larger effects.



Radio Blackouts - X-Ray Flares:

Solar Activity is currently Low, with up to five surviving sunspot regions currently on the disc. There is a daily Chance of M-class X-ray flares.

The main region of interest is AR3395 in the northwest disc. This is a slowly growing region of moderate size, with a complex parity separation line and a number of delta spots evident. This includes the development of a number of dark umbra cores in the last 24 hours, with flux emergence to its north and west.

There are two other regions of interest, AR3394 in the southwest and AR3397 in the north-centre disc. AR3394 is a stable, but moderately sized region, with some small complexity in its magnetic structure and if it were to reactivate would have the potential for M-class flares. AR3397 is a small region that has seen recent emergence and growth, and will need monitoring for any further development. A recent C-class flare has also been observed over the northeast limb, however it is currently too soon to determine the source of this activity.

X Ray Flares	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability			(%)	(%)	(%)	(%)
Active	R1-R2 M Class	No	40	40	40	40
Very Active	R3 to R5 X Class	No	2	2	2	2

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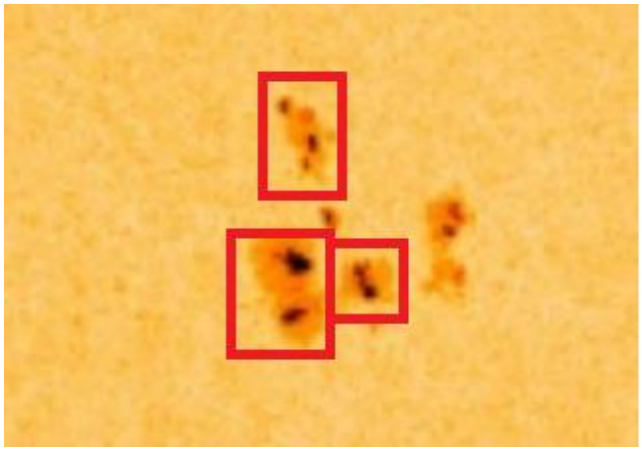
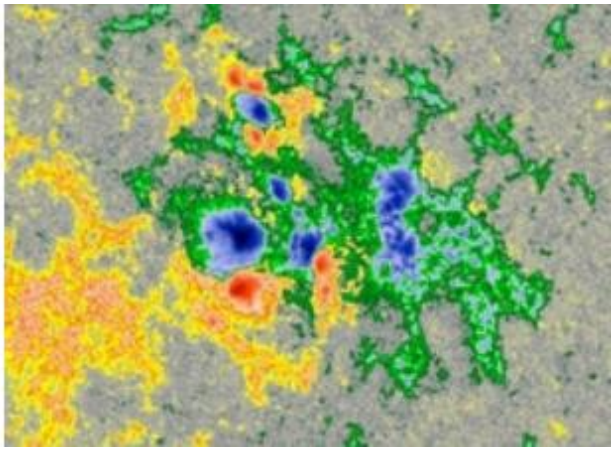
Figure 3: HMIIF and HMIBC imagery of AR3395 at 11/2300UTC, showing Dac/Beta-Gamma-Delta complexity, with the numerous delta spot candidates shown boxed red.





Solar Radiation Storms - (High Energy Protons):

The flux of high energy (greater than 10 MeV) remains slightly above background but is continuing to ease. The source of the recent enhancement is now well beyond the limb, and unlikely to influence solar radiation levels detectable at Earth. There remains a residual daily Slight Chance of the proton flux increasing however, given the ongoing development of AR3395 in the northwest, and if any development or activation of the large sport AR3394 occurs in the southwest.

Radiation Storms	**Level (cm^{-2} sr^{-1} s^{-1})**	**Past 24 Hours (Yes/No)**	**Day 1 (00-24 UTC)**	**Day 2 (00-24 UTC)**	**Day 3 (00-24 UTC)**	**Day 4 (00-24 UTC)**
Probability (Exceedance)			**(%)**	**(%)**	**(%)**	**(%)**
Active	**≥ S1**	No	5	5	5	5
Very Active	**≥ S3 ***	No	1	1	1	1
* S3 ≥ 10 MeV ≥ 1000 pfu and / or ≥ 50 MeV ≥ 10 pfu. (pfu = $cm^{-2}sr^{-1}s^{-1}$)						

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High Energy Electrons Event (≥ 2MeV):

The high energy (greater than 2 MeV) electron flux is expected to be mainly at Moderate levels, but showing a diurnal variation from Background to High, likely peaking just over 1000pfu each day. This is likely to be attenuated into the final day of the forecast period, however any rebound towards Active fluence is not expected until the middle of the coming UTC week at the earliest.

The associated fluence is expected to remain below the Active level, with REFM currently providing good guidance.

GEO Electron Environment Probability (Exceedance)	Level (cm^{-2} sr^{-1} day^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ 2 MeV ≥ $1x10^8$**	No	1	5	5	1
Very Active	**≥ 2 MeV ≥ $1x10^9$**	No	1	1	1	1

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